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BRIDGING THE GAP: A CASE REPORT ON ALVEOLAR BONE GRAFTING FOR UNILATERAL CLEFT REPAIR

Maxillofacial Surgery

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ABSTRACT

Introduction: Alveolar clefts are common congenital anomalies associated with unilateral or bilateral cleft lip and palate, affecting both function and aesthetics, thereby reducing quality of life. They can impair feeding, speech, and dental development, and may cause disruption of the alveolar ridge and permanent tooth eruption. Various surgical techniques have been developed to repair these defects and restore oral function. **Case Report:** An 11-year-old boy with a unilateral complete cleft lip and palate presented with an unrepaired alveolar cleft. Surgical repair was performed using bone harvested from the anterior iliac crest, successfully augmenting the defect and restoring alveolar continuity. This enabled proper eruption of the permanent maxillary canine and facilitated further orthodontic treatment. **Discussion:** Alveolar clefts require a multidisciplinary approach involving surgery, orthodontics, dental care, and speech therapy. The primary goal is to close the cleft, restore function, and support normal dental development. **Conclusion:** Timely surgical repair of alveolar clefts is essential in patients with cleft lip and palate. This case highlights a successful approach using autogenous bone grafting and soft tissue management to improve oral health and quality of life.

KEYWORDS

Alveolar Bone cleft, Alveolar Bone Grafting, Case Report, Iliac Bone Graft, Secondary Alveolar Bone Grafting

INTRODUCTION

Cleft surgery in both children and adults aims to restore normal anatomy and function. Over time, the approach to lip and palate repair has evolved, with early recognition of the need to address the alveolar cleft, even before it was surgically feasible [1,2]. Surgeons also acknowledged the importance of repairing both nasal and oral layers [3]. Today, the standard approach is **secondary alveolar bone grafting (ABG)**, typically performed before the eruption of the permanent maxillary canine.

Although termed "secondary," ABG is essentially a primary cleft procedure, along with lip and palate repairs. True secondary procedures, such as orthognathic surgery, rhinoplasty, and velopharyngeal correction, occur later in life.

Historically, some surgeons performed **primary ABG** using autogenous rib grafts between 6 months and 4 years of age during primary dentition [4,5]. While early outcomes were promising, concerns later emerged about impaired maxillary growth and inadequate bone for permanent tooth eruption, often necessitating repeat grafting. As a result, primary ABG has largely been abandoned in favor of the standard secondary approach.

Secondary ABG, typically done between ages 9 and 11 based on dental development, was formalized by Boyne and Sands in 1972 and further validated by Abyholm, Bergland, and Semb in 1981 [5–7].

The Key Objectives Include:

1. Enabling eruption or orthodontic alignment of teeth in the cleft area [8]
2. Providing bony support to adjacent teeth and preventing maxillary arch collapse [9]
3. Closing oronasal fistulas [9]
4. Supporting the nasal base and alar region [9]
5. Improving speech and articulation [10]

Currently, the **iliac crest** is the preferred donor site due to its rich supply of cancellous bone with endochondral potential, making it ideal for reconstructing large alveolar defects [11].

Case Report

An 11-year-old boy presented to the OPD of Haldia Institute of Dental Sciences and Research with complaints of delayed tooth eruption and malaligned upper anterior teeth, affecting speech and chewing. He had previously undergone cleft lip and palate repairs at 3 months and 1 year of age, and completed maxillary arch expansion with retention in June 2023. There was no relevant family or medical history, and no known allergies.

Extraoral examination revealed upper lip scars and facial asymmetry. Intraorally, a collapsed maxillary arch and an alveolar cleft were noted on the left side in the region of teeth 62 and 63, with a crossbite on the left and Class I molar relation on the right (Figure 1).

Figure 1 : (a,b) Preoperative Intraoral Photographs of patient

An orthopantomogram showed erupting maxillary canine (tooth 23) with two-thirds root formation (Figure 2a). CBCT revealed discontinuity of the alveolar ridge, with a cleft width of 8.6 mm buccally and 11 mm palatally (Figure 2 b,c).

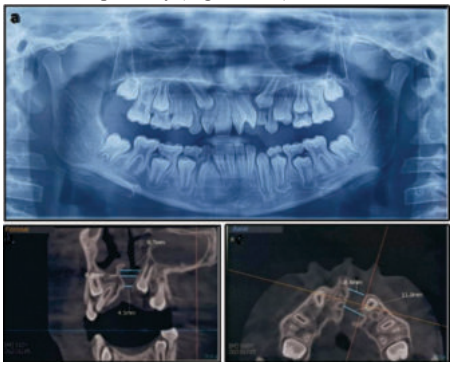

Figure 2 : (a) Preoperative Orthopantamogram showing maxillary canine with two third root completion (b) Cone Beam Computed Tomography (Coronal) demonstrating dimensions of the defect (c) Cone Beam Computed Tomography (Axial)

A treatment plan involving secondary alveolar bone grafting using autogenous cancellous bone from the anterior iliac crest was formulated. The procedure was performed under general anesthesia at B.C. Roy Hospital. Following local infiltration with 2% lidocaine with epinephrine, full-thickness mucoperiosteal flaps were elevated from teeth 12 to 24, and the cleft margins were freshened (Figure 4a).

Bone graft harvesting involved a 3–4 cm incision 2 cm posterior to the ASIS (Figure 3a), with careful dissection to avoid nerve damage. A medial trapdoor was created (Figure 3b), and 7–8 c.c. of cancellous bone was harvested. Platelet-rich fibrin (PRF) was prepared from the patient's blood and mixed with the graft material (Figure 4b), which was compactly packed to the level of the nasal floor (Figure 4c).

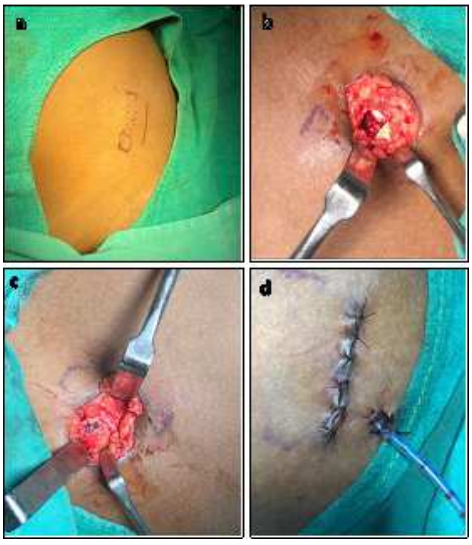

Figure 3 : (a) Incision marking of Donor site (Anterior Iliac Crest) (b) Dissection to the aponeurosis of muscles. Medial Trap door opened with the periosteum attached harvesting of cancellous bone (c) Closure of donor site performed in layers. (d) Final closure of Skin and placement of drain

Donor site closure involved hemostasis, placement of an active mini drain, and layered closure using 4-0 polyglactin and 5-0 nylon sutures (Figure 3 c,d). The recipient site was closed tension-free with a combination of simple interrupted, horizontal mattress, and sling sutures using 4-0 polyglactin (Figure 4d).

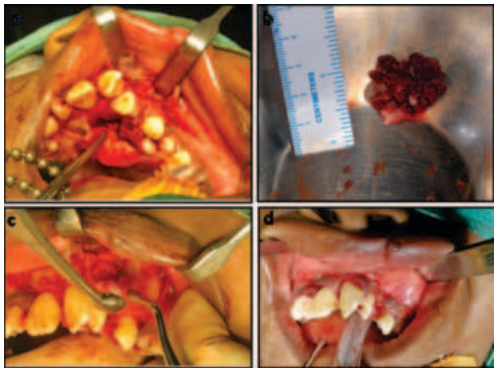

Figure 4 : (a) Buccal and Palatal Flaps reflected (b) Bone graft mixed with PRF to prepare a moldable mass. (c) Graft being packed in the defect site (d) Intraoral closure done in layers

Follow-Up

The patient received IV antibiotics for one day, followed by a 7-day course of oral antibiotics. A liquid diet was maintained for the first week, transitioning to a soft diet. The drain was removed on postoperative day two, and donor site sutures on day ten. Postoperative pain was managed with analgesics, and early ambulation was encouraged to reduce discomfort. No complications such as hematoma, seroma, paresthesia, or gait disturbances were observed. The intraoral surgical site healed uneventfully during hospitalization and follow-up (Figure 5 a,b). Chlorhexidine mouth rinse was advised until the seventh postoperative day.

Figure 5 : (a,b) 3 months follow up pictures demonstrating successful eruption of maxillary canine in grafted site.

DISCUSSION

Alveolar cleft repair remains a key focus in oral and maxillofacial surgery. Cleft lip and palate are the most common craniofacial birth defects and second overall among congenital malformations, following clubfoot [12].

Alveolar bone grafting is essential in managing cleft-related defects. Its main goals are to create a continuous dental arch, restore function, close oronasal fistulae, support tooth eruption and implant placement, and enhance nasal and facial structure [13]. Alveolar clefts often hinder normal tooth eruption. Timely grafting allows proper tooth eruption, bringing periodontal support and stabilizing adjacent teeth, thus preventing maxillary arch collapse. This improves orthodontic outcomes, such as incisor derotation and alignment of palatally erupted canines.

The maxillary canine on the cleft side is particularly important. A well-timed graft enables its eruption, even if adjacent teeth (e.g., lateral incisor) are missing. In such cases, grafting can still maintain arch continuity and may eliminate the need for prosthetics. If tooth gaps remain, a robust graft can support dental prostheses or implants.

Secondary alveolar bone grafting (ABG), ideally performed between ages 9–11 when the canine root is one-third to two-thirds formed, reduces risks like root resorption and periodontal loss.

Multiple donor sites exist, including the tibia, rib, calvarium, and mandibular symphysis. However, the iliac crest is preferred for its abundant cancellous bone and osteogenic potential, promoting rapid vascularization [14]. Despite benefits, iliac grafting carries donor site risks such as nerve injury, pain, and gait disturbances, which may be mitigated using alternatives like bone morphogenetic proteins or zygoma shavings.

Literature reviews show that combining autografts with deproteinized bovine bone or β-tricalcium phosphate reduces the need for iliac harvesting and associated morbidity. However, bovine hydroxyapatite alone yields lower bone density than autografts [15].

A systematic review comparing autologous iliac bone and alloplastic rhBMP-2 grafts (via CT imaging) found that autologous grafts yielded superior bone height and volume after 6 months [16]. Despite surgical advances, the ideal graft source remains debated [17].

Platelet-rich fibrin (PRF), rich in platelets and cytokines, releases growth factors (e.g., PDGF, TGF-β, BMP), promoting angiogenesis, osteoblast activity, and graft integration. Its fibrin matrix supports cell migration, neovascularization, and graft survival [18].

This case report highlights an integrated approach to alveolar cleft repair, emphasizing recipient site preparation and the use of advanced PRF to enhance autogenous graft outcomes.

CONCLUSION

Alveolar bone grafting remains a fundamental component of oral and maxillofacial surgical care for patients with cleft lip and palate, playing a vital role in functional oral rehabilitation and improving overall quality of life. Numerous surgical techniques and grafting materials have been explored for optimal outcomes in alveolar cleft repair. This case demonstrates the successful application of autogenous cancellous bone grafting from the anterior iliac crest, combined with PRF, to achieve alveolar continuity and support the eruption of the permanent maxillary canine. The treatment protocol yielded favorable results and underscores the importance of individualized, multidisciplinary care in achieving long-term stability and functional success.

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